DRINKING WATER SURVEILLANCE PROGRAM

SARNIA (LAMBTON COUNTY) WATER TREATMENT PLANT

ANNUAL REPORT 1990

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EXECUTIVE SUMMARY

DRINKING WATER SURVEILLANCE PROGRAM

SARNIA (LAMBTON COUNTY) WATER TREATMENT PLANT
1990 ANNUAL REPORT

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

The Sarnia (Lambton County) water treatment plant is a direct filtration plant which treats water from the St. Clair River. The process consists of coagulation, flocculation, filtration and disinfection. This plant has a rated capacity of 188.5 x 1000 m^3/day. The Sarnia (Lambton County) water treatment plant serves a population of approximately 104,200.

Water at the plant and at one location in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall.

Table A is a summary of all results by group.

No known health related guidelines were exceeded.

The Sarnia (Lambton County) water treatment plant, for the sample year of 1990, produced good quality water and this was maintained in the distribution system.

TABLE A

DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY) WTP

SUMMARY TABLE BY SCAN

A POSITIVE VALUE DENOTES THAT THE RESULT IS GREATER THAN THE STATISTICAL LIMIT OF DETECTION AND IS QUANTIFIABLE
A '.' INDICATES THAT NO SAMPLE WAS TAKEN

SCAN	SITE RAW TESTS	RAW POSITIVE	RAW %POSITIVE	TREATED TESTS	TREATED POSITIVE	TREATED %POSITIVE	SITE 1 TESTS	SITE 1 POSITIVE	SITE 1 %POSITIVE
BACTERIOLOGICAL	3	1	33	6	3	50	6	2	33
CHEMISTRY (FLD)	18	18	100	36	33	91	70	69	98
CHEMISTRY (LAB)	132	98	74	131	96	73	225	186	82
METALS	144	36	25	144	38	26	276	98	35
CHLOROAROMATICS	84	0	0	70	0	0	56	0	0
CHLOROPHENOLS	6	0	0	12	0	0	.	.	.
PAH	67	0	0	101	0	0	.	.	.
PESTICIDES & PCB	205	0	0	183	0	0	84	0	0
PHENOLICS	6	0	0	6	0	0	.	.	.
SPECIFIC PESTICIDES	31	0	0	57	0	0	4	0	0
VOLATILES	174	0	0	174	24	13	174	24	13
TOTAL	870	153		920	194		895	379	

DRINKING WATER SURVEILLANCE PROGRAM

SARNIA (LAMBTON COUNTY) WATER TREATMENT PLANT
1990 ANNUAL REPORT

INTRODUCTION

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

Appendix A has a full description of the DWSP.

The DWSP was initiated for the Sarnia (Lambton County) water treatment plant in the fall of 1985 as part of a study on the St Clair/Detroit River area. Previous annual reports have been published for 1986, 1987, 1988 and 1989.

PLANT DESCRIPTION

The Sarnia (Lambton County) water treatment plant is a direct filtration plant which treats water from the St. Clair River. The process consists of coagulation, flocculation, filtration and disinfection. This plant has a rated capacity of 188.5 x 1000 m^3/day. The Sarnia (Lambton County) water treatment plant serves a population of approximately 104,200.

The sample day flows ranged from 60.0 x 1000 m^3/day to 114.9 x 1000 m^3/day.

General plant information is presented in Table 1 and a schematic of plant processes, chemical addition points and sampling locations in Figure 1.

SAMPLING AND ANALYSES

Sample lines in the plant were flushed prior to sampling to ensure that the water obtained was indicative of its origin and not residual water standing in the sample line.

At all distribution system locations two types of samples were obtained, a standing and a free flow. The standing sample consisted of water that had been in the household plumbing and service connection for a minimum of six hours. These samples were used to make an assessment of the change in the levels of inorganic compounds and metals, due to leaching from, or deposition on, the

plumbing system. The only analyses carried out on the standing samples therefore, were General Chemistry and Metals. The free flow sample represented fresh water from the distribution main, since the sample tap was flushed for five minutes prior to sampling.

Attempts were made to capture the same block of water at each sampling point by taking the retention time into consideration. Retention time was calculated by dividing the volume of water between two sampling points by sample day flow. For example, if it was determined that retention time within the plant was five hours, then there would be a five hour interval between the raw and treated sampling. Similarly, if it was estimated that it took approximately one day for the water to travel from the plant to the distribution system site, this site would be sampled one day after the treated water from the plant.

Stringent DWSP sampling protocols were followed to ensure that all samples were taken in a uniform manner (see Appendix B).

Plant operating personnel routinely analyze parameters for process control (Table 2).

Water at the plant and at one location in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall. Laboratory analyses were conducted at the Ministry of the Environment facilities in Rexdale, Ontario.

RESULTS

Field measurements were recorded on the day of sampling and were entered onto the DWSP database as submitted by plant personnel.

Table 3 contains information on delay time between raw and treated water sampling, flow rate, and treatment chemical dosages.

Table 4 is a summary break-down of the number of water samples analyzed by parameter and by water type. The number of times that a positive or trace result was detected is also reported.

Positive denotes that the result is greater than the statistical limit of detection established by the Ministry of the Environment laboratory staff and is quantifiable. Trace (<T) denotes that the level measured is greater than the lowest value detectable by the method but lies so close to the detection limit that it cannot be confidently quantified.

Table 5 presents the results for parameters detected on at least one occasion.

Table 6 lists all parameters analyzed in the DWSP.

Associated guidelines and detection limits are also supplied on Tables 5 and 6. Parameters are listed alphabetically within each scan.

DISCUSSION

GENERAL

Water quality was judged by comparison with the Ontario Drinking Water Objectives publication (ODWOs). When an Ontario Drinking Water Objective (ODWO) was not available, guidelines/limits from other agencies were used. These guidelines were obtained from the Parameter Listing System database.

IN THIS REPORT, DISCUSSION IS LIMITED TO:

- **THE TREATED AND DISTRIBUTED WATER;**
- **ONLY THOSE PARAMETERS WITH CONCENTRATIONS ABOVE GUIDELINE VALUES; AND**
- **POSITIVE ORGANIC PARAMETERS DETECTED.**

BACTERIOLOGICAL

Guidelines for bacteriological sampling and testing of a supply are developed to maintain a proper supervision of its bacteriological quality. Routine monitoring programs usually require that multiple samples be collected in a given system. Full interpretation of bacteriological quality cannot be made on the basis of single samples.

Standard plate count is a test used to supplement routine analysis for Coliform bacteria. The limit for standard plate count (at 35°C after 48 hours) in the ODWOs is 500 counts/mL (based on a geometric mean of 5 or more samples). DWSP bacteriological analysis of treated and distributed water was limited to standard plate count, which may indicate some deterioration in water quality if the guideline of 500 counts/mL is exceeded.

Standard plate count (membrane filtration) exceeded the ODWO Maximum Desirable Concentration of 500/counts/mL in 3 of 4 treated water samples with a maximum reported value of 2.400 counts/mL.

INORGANIC & PHYSICAL

CHEMISTRY (FIELD)

It is desirable that the temperature of drinking water be less than 15°C. The palatability of water is enhanced by its coolness. A temperature below 15°C will tend to reduce the growth of nuisance organisms and hence minimize associated taste, colour, odour and corrosion problems. The temperature of the delivered water may increase in the distribution system due to the warming effect of the soil in late summer and fall and/or as a result of higher temperatures in the source water.

Field temperature exceeded the ODWO Maximum Desirable Concentration of 15°C in 4 of 12 treated and distributed water samples, with a maximum reported value of 22.0°C.

CHEMISTRY (LAB)

The ODWOs indicate that a hardness level of between 80 and 100 mg/L as calcium carbonate for domestic waters provides an acceptable balance between corrosion and encrustation. Water supplies with a hardness greater than 200 mg/L are considered poor and would possess a tendency to form scale deposits and result in excessive soap consumption.

Hardness exceeded the ODWO Aesthetic or Recommended Operational Guideline of 80-100 mg/L in 12 of 12 treated and distributed water samples with a maximum reported value of 109.5 mg/L.

METALS

At present, there is no evidence that aluminum is physiologically harmful and no health limit for drinking water has been specified. The measure of aluminum in treated water is important to indicate the efficiency of the treatment process. The ODWOs indicate that a useful guideline is to maintain a residual below 100 ug/L as aluminum in the water leaving the plant, to avoid problems in the distribution system.

Aluminum exceeded the ODWO Aesthetic or Recommended Operational Guideline of 100 ug/L in 2 of 12 treated and distributed water samples with a maximum reported value of 140.0 ug/L.

ORGANIC

CHLOROAROMATICS

The results of the chloroaromatic scan showed that none were detected.

CHLOROPHENOLS

The results of the chlorophenol scan showed that none were detected.

POLYAROMATIC HYDROCARBONS (PAH)

The results of the polyaromatic hydrocarbon scan (PAH) showed that none were detected.

PESTICIDES & PCB

The results of the pesticide & PCB scan showed that none were detected above trace levels.

PHENOLICS

Phenolic compounds are present in the aquatic environment as a result of natural and/or industrial processes. The ODWOs recommend, as an operational guideline, that phenolic substances in drinking water not exceed 2.0 ug/L. This limit has been set primarily to prevent undesirable taste and odours, particularly in chlorinated water. No results exceeded the guideline.

SPECIFIC PESTICIDES

The results of the specific pesticide scan showed that none were detected.

VOLATILES

The detection of benzene, ethylbenzene, toluene and xylenes at low, trace levels may be a laboratory artifact derived from the analytical methodology.

Trihalomethanes (THMs) are produced during the water treatment process and will always occur in chlorinated waters. THMs are comprised of chloroform, chlorodibromomethane and dichlorobromomethane; bromoform occurs occasionally. Results are reported for the individual compounds as well as for total THMs. Only total THMs results are discussed.

Total THMs were found at positive levels in the 12 treated and distributed water samples analyzed with a maximum level of 39.8 ug/L. This was below the ODWO Maximum Acceptable Concentration of 350 ug/L.

CONCLUSIONS

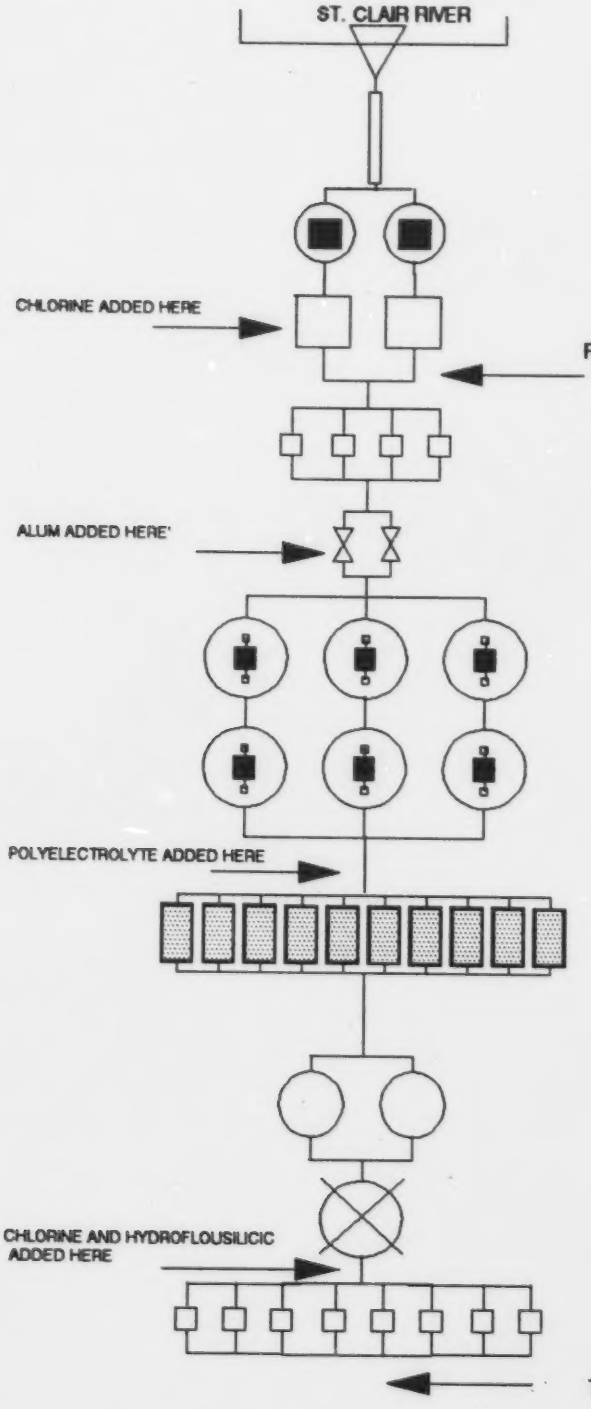
The Sarnia (Lambton County) water treatment plant, for the sample year of 1990, produced good quality water and this was maintained in the distribution system.

No known health related guidelines were exceeded.

FIGURE 1

SARNIA(LAMBTON AREA) WTP

SCHEMATIC DIAGRAM



CHARACTERISTICS

1 INTAKE PIPE

2 SURGE & SCREEN WELLS

2 LOWLIFT CHAMBERS

RAW WATER SAMPLE SITE

4 LOWLIFT PUMPS

2 FLASH MIXERS

6 FLOCCULATION TANKS

10 FILTER TANKS

2 CLEARWELLS

1 RESERVOIR

8 HIGHLIFT PUMPS

TREATED WATER SAMPLE SITE

TABLE 1

DRINKING WATER SURVEILLANCE PROGRAM

PLANT GENERAL REPORT

WORKS #: 210000906
PLANT NAME: SARNIA (LAMBTON COUNTY WTP)

DISTRICT: SARNIA
REGION: SOUTHWEST
DISTRICT OFFICER: O. WIGLE

UTM #: 173842704761840

PLANT SUPERINTENDENT: JIM HORSBURGH

ADDRESS: 1215 FORT STREET P.O. BOX 790
SARNIA,ONTARIO
N7V 1M1
(519 344-7429)

MUNICIPALITY: SARNIA
AUTHORITY: PROVINCIAL

PLANT INFORMATION

PLANT VOLUME:	82.9	(X 1000 M3)
DESIGN CAPACITY:	188.5	(X 1000 M3/DAY)
RATED CAPACITY:	188.5	(X 1000 M3/DAY)

MUNICIPALITY	POPULATION
BOSANQUET TWSP	4,650
BRIGDEN	663
FOREST	2,800
MOORE TWP	10,097
PLYMPTON TWSP	4,860
POINT EDWARD VILLAGE	2,373
SARNIA CITY	50,233
SARNIA TWP	20,913
SOMBRA	4,249
WATFORD	1,500
WYOMING	1,824

TABLE 2
DRINKING WATER SURVEILLANCE PROGRAM
IN-PLANT MONITORING

PARAMETER	LOCATION	FREQUENCY
ALGEA	TREATED WATER IN LAB	MONTHLY
	RAW WATER IN LAB	MONTHLY
FREE CHLORINE RESIDUAL	TREATED WATER IN LAB	EVERY 4 HOURS
	SETTLED WATER IN LAB	EVERY 4 HOURS
	AFTER FILTERS	CONTINUOUS
FLUORIDE	TREATED WATER IN LAB	EVERY 4 HOURS
	RAW WATER IN LAB	WEEKLY
AMMONIA TEST	TREATED WATER IN LAB	EVERY 4 HOURS
	SETTLED WATER IN LAB	EVERY 4 HOURS
PH	RAW WATER	EVERY 4 HOURS
	TREATED WATER	EVERY 4 HOURS
TEMPERATURE	TREATED WATER IN LAB	DAILY READING
	RAW WATER IN LAB	DAILY READING
TURBIDITY	SETTLED WATER IN LAB	DAILY
	FILTERED WATER IN LAB	CONTINUOUS
	AFTER FILTERS	EVERY 4 HOURS
	RAW WATER	EVERY 4 HOURS
	TREATED WATER	EVERY 4 HOURS

TABLE 3

DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) SAMPLE DAY CONDITIONS FO 1990

			TREATMENT CHAEMICAL DOSAGE (MG/L)			
			PRE CHLORINATION	COAGULATION	FLUORIDATION	POST CHLORINATION
			CHLORINE	ALUM LIQUID	HYDROFLUOSILICIC ACI	CHLORINE
DATE	DELAY * TIME(HRS)	FLOW (1000M3)				
JAN 04	25.68	77.760	.54	5.73	1.10	.78
MAR 07	24.00	69.700	1.10	7.67	1.21	.25
MAY 09	-	-	1.00	6.30	1.20	.80
JUL 05	17.52	114.900	1.18	9.20	1.21	.26
NOV 07	7.52	60.020	1.30	10.15		.19

* THE DELAY TIME BETWEEN THE RAW AND TREATED WATER SAMPLING, SHOULD ESTIMATE THE RETENTION TIME.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP)
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
BACTERIOLOGICAL									
FECAL COLIFORM MF	1	0	0	.	.	.	.	.	.
STANDRD PLATE CNT MF	.	.	.	6	3	0	6	2	0
TOTAL COLIFORM MF	1	0	0	.	.	.	.	.	.
T COLIFORM BCKGRD MF	1	1	0	.	.	.	.	.	.
*TOTAL GROUP BACTERIOLOGICAL	3	1	0	6	3	0	6	2	0
CHEMISTRY (FLD)									
FLD CHLORINE (COMB)	.	.	.	6	5	0	12	12	0
FLD CHLORINE FREE	.	.	.	6	5	0	12	11	0
FLD CHLORINE (TOTAL)	.	.	.	6	5	0	12	12	0
FLD PH	6	6	0	6	6	0	12	12	0
FLD TEMPERATURE	6	6	0	6	6	0	12	12	0
FLD TURBIDITY	6	6	0	6	6	0	10	10	0
*TOTAL SCAN CHEMISTRY (FLD)	18	18	0	36	33	0	70	69	0
CHEMISTRY (LAB)									
ALKALINITY	6	6	0	6	6	0	12	12	0
CALCIUM	6	6	0	6	6	0	12	12	0
CYANIDE	6	0	0	6	0	0	.	.	.
CHLORIDE	6	6	0	6	6	0	12	12	0
COLOUR	6	0	6	6	0	4	12	0	8
CONDUCTIVITY	6	6	0	6	6	0	12	12	0
DISS ORG CARBON	6	6	0	6	6	0	12	12	0
FLUORIDE	6	6	0	6	5	1	12	12	0
HARDNESS	6	6	0	6	6	0	12	12	0
IONCAL	6	6	0	6	6	0	12	12	0
LANGELIERS INDEX	6	6	0	5	5	0	9	9	0
MAGNESIUM	6	6	0	6	6	0	12	12	0
SODIUM	6	6	0	6	6	0	12	12	0
AMMONIUM TOTAL	6	0	1	6	0	1	12	0	3
NITRITE	6	2	4	6	1	3	12	2	7
TOTAL NITRATES	6	6	0	6	6	0	12	12	0
NITROGEN TOT KJELD	6	6	0	6	4	2	12	9	3
PH	6	6	0	6	6	0	12	12	0
PHOSPHORUS FIL REACT	6	0	2	6	3	2	.	.	.
PHOSPHORUS TOTAL	6	0	6	6	0	5	.	.	.
SULPHATE	6	6	0	6	6	0	12	12	0
TURBIDITY	6	6	0	6	6	0	12	10	2
*TOTAL SCAN CHEMISTRY (LAB)	132	98	19	131	96	18	225	186	23

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP)
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
METALS									
SILVER	6	0	0	6	0	0	12	0	0
ALUMINUM	6	6	0	6	6	0	12	12	0
ARSENIC	6	0	6	6	0	6	12	0	12
BARIUM	6	6	0	6	6	0	12	12	0
BORON	6	2	4	6	0	6	12	4	8
BERYLLIUM	6	0	0	6	0	0	12	0	0
CADMIUM	6	0	0	6	0	1	12	0	1
COBALT	6	0	3	6	0	6	12	0	7
CHROMIUM	6	0	5	6	0	4	12	0	10
COPPER	6	6	0	6	3	3	12	7	5
IRON	6	0	4	6	0	5	12	0	8
MERCURY	6	0	2	6	0	1	.	.	.
MANGANESE	6	5	1	6	4	2	12	10	2
MOLYBDENUM	6	1	5	6	1	5	12	5	7
NICKEL	6	0	5	6	0	2	12	2	7
LEAD	6	0	6	6	0	5	12	10	2
ANTIMONY	6	2	4	6	2	4	12	4	8
SELENIUM	6	0	1	6	0	0	12	0	6
STRONTIUM	6	6	0	6	6	0	12	12	0
TITANIUM	6	0	6	6	0	6	12	6	6
THALLIUM	6	0	0	6	0	0	12	0	0
URANIUM	6	0	6	6	0	6	12	0	12
VANADIUM	6	0	6	6	4	2	12	5	7
ZINC	6	2	4	6	6	0	12	9	3
*TOTAL SCAN METALS	144	36	68	144	38	64	276	98	111
*TOTAL GROUP INORGANIC & PHYSICAL	294	152	87	311	167	82	571	353	134
CHLOROAROMATICS									
HEXACHLOROBUTADIENE	6	0	0	5	0	0	4	0	0
123 TRICHLOROBENZENE	6	0	0	5	0	0	4	0	0
1234 T-CHLOROBENZENE	6	0	0	5	0	0	4	0	0
1235 T-CHLOROBENZENE	6	0	0	5	0	0	4	0	0
124 TRICHLOROBENZENE	6	0	0	5	0	0	4	0	0
1245 T-CHLOROBENZENE	6	0	0	5	0	0	4	0	0
135 TRICHLOROBENZENE	6	0	0	5	0	0	4	0	0
HCB	6	0	0	5	0	0	4	0	0
HEXACHLOROETHANE	6	0	0	5	0	0	4	0	0
OCTACHLOROSTYRENE	6	0	0	5	0	0	4	0	0
PENTACHLOROBENZENE	6	0	0	5	0	0	4	0	0
236 TRICHLOROTOLUENE	6	0	0	5	0	0	4	0	0
245 TRICHLOROTOLUENE	6	0	0	5	0	0	4	0	0
26A TRICHLOROTOLUENE	6	0	0	5	0	0	4	0	0
*TOTAL SCAN CHLOROAROMATICS	84	0	0	70	0	0	56	0	0
CHLOROPHENOLS									

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP)
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
234 TRICHLOROPHENOL	1	0	0	2	0	0	.	.	.
2345 T-CHLOROPHENOL	1	0	0	2	0	0	.	.	.
2356 T-CHLOROPHENOL	1	0	0	2	0	0	.	.	.
245-TRICHLOROPHENOL	1	0	0	2	0	0	.	.	.
246-TRICHLOROPHENOL	1	0	0	2	0	0	.	.	.
PENTACHLOROPHENOL	1	0	0	2	0	0	.	.	.
*TOTAL SCAN CHLOROPHENOLS	6	0	0	12	0	0	0	0	0
PAH									
PHENANTHRENE	4	0	0	6	0	0	.	.	.
ANTHRACENE	4	0	0	6	0	0	.	.	.
FLUORANTHENE	4	0	0	6	0	0	.	.	.
PYRENE	4	0	0	6	0	0	.	.	.
BENZO(A)ANTHRACENE	4	0	0	6	0	0	.	.	.
CHRYSENE	4	0	0	6	0	0	.	.	.
DIMETH. BENZ(A)ANTHR	3	0	0	5	0	0	.	.	.
BENZO(E) PYRENE	4	0	0	6	0	0	.	.	.
BENZO(B) FLUORANTHEN	4	0	0	6	0	0	.	.	.
PERYLENE	4	0	0	6	0	0	.	.	.
BENZO(K) FLUORANTHEN	4	0	0	6	0	0	.	.	.
BENZO(A) PYRENE	4	0	0	6	0	0	.	.	.
BENZO(G,H,I) PERYLEN	4	0	0	6	0	0	.	.	.
DIBENZO(A,H) ANTHRAC	4	0	0	6	0	0	.	.	.
INDENO(1,2,3-C,D) PY	4	0	0	6	0	0	.	.	.
BENZO(B) CHRYSENE	4	0	0	6	0	0	.	.	.
CORONENE	4	0	0	6	0	0	.	.	.
*TOTAL SCAN PAH	67	0	0	101	0	0	0	0	0
PESTICIDES & PCB									
ALDRIN	6	0	0	5	0	0	4	0	0
ALPHA BHC	6	0	5	5	0	5	4	0	4
BETA BHC	6	0	0	5	0	0	4	0	0
LINDANE	6	0	0	5	0	0	4	0	0
ALPHA CHLORDANE	6	0	0	5	0	0	4	0	0
GAMMA CHLORDANE	6	0	0	5	0	0	4	0	0
DIELDRIN	6	0	0	5	0	0	4	0	0
METHOXYCHLOR	6	0	0	5	0	0	4	0	0
ENDOSULFAN 1	6	0	0	5	0	0	4	0	0
ENDOSULFAN II	6	0	0	5	0	0	4	0	0
ENDRIN	6	0	0	5	0	0	4	0	0
ENDOSULFAN SULPHATE	6	0	0	5	0	0	4	0	0
HEPTACHLOR EPOXIDE	6	0	0	5	0	0	4	0	0
HEPTACHLOR	6	0	0	5	0	0	4	0	0
MIREX	6	0	0	5	0	0	4	0	0
OXYCHLORDANE	6	0	0	5	0	0	4	0	0
OPDDT	6	0	0	5	0	0	4	0	0
PCB	6	0	0	5	0	0	4	0	0
DDD	6	0	0	5	0	0	4	0	0
PPDDE	6	0	0	5	0	0	4	0	0

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP)
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
PPDDT	6	0	0	5	0	0	4	0	0
AMETRINE	6	0	0	6	0	0	.	.	.
ATRAZINE	6	0	0	6	0	0	.	.	.
ATRATONE	6	0	0	6	0	0	.	.	.
CYANAZINE (BLADEX)	6	0	0	6	0	0	.	.	.
DESETHYLATRAZINE	6	0	0	6	0	0	.	.	.
D-ETHYL SIMAZINE	6	0	0	5	0	0	.	.	.
PROMETONE	6	0	0	6	0	0	.	.	.
PROPAZINE	6	0	0	6	0	0	.	.	.
PROMETRYNE	6	0	0	6	0	0	.	.	.
METRIBUZIN (SENCOR)	6	0	0	6	0	0	.	.	.
SIMAZINE	6	0	0	6	0	0	.	.	.
ALACHLOR (LASSO)	6	0	0	6	0	0	.	.	.
METOLACHLOR	6	0	0	6	0	0	.	.	.
HEXACLCYCLOPENTADIEN	1	0	0	1	0	0	0	0	0
*TOTAL SCAN PESTICIDES & PCB	205	0	5	183	0	5	84	0	4
PHENOLICS									
PHENOLICS	6	0	3	6	0	2	.	.	.
*TOTAL SCAN PHENOLICS	6	0	3	6	0	2	0	0	0
SPECIFIC PESTICIDES									
TOXAPHENE	6	0	0	5	0	0	4	0	0
2,4,5-T	1	0	0	2	0	0	.	.	.
2,4-D	1	0	0	2	0	0	.	.	.
2,4-DB	1	0	0	2	0	0	.	.	.
2,4 D PROPIONIC ACID	1	0	0	2	0	0	.	.	.
DICAMBA	0	0	0	1	0	0	.	.	.
PICHLORAM	0	0	0	1	0	0	.	.	.
SILVEX	1	0	0	2	0	0	.	.	.
DIAZINON	1	0	0	2	0	0	.	.	.
DICHLOROVOS	1	0	0	2	0	0	.	.	.
CHLORPYRIFOS	1	0	0	2	0	0	.	.	.
ETHION	1	0	0	2	0	0	.	.	.
AZINPHOS-METHYL	0	0	0	0	0	0	.	.	.
MALATHION	1	0	0	2	0	0	.	.	.
MEVINPHOS	1	0	0	2	0	0	.	.	.
METHYL PARATHION	1	0	0	2	0	0	.	.	.
METHYLTRITHION	1	0	0	2	0	0	.	.	.
PARATHION	1	0	0	2	0	0	.	.	.
PHORATE	1	0	0	2	0	0	.	.	.
RELDAN	1	0	0	2	0	0	.	.	.
RONNEL	1	0	0	2	0	0	.	.	.
AMINOCARB	0	0	0	0	0	0	.	.	.
BENONYL	0	0	0	0	0	0	.	.	.
BUX	0	0	0	0	0	0	.	.	.
CARBOFURAN	1	0	0	2	0	0	.	.	.
CICP	1	0	0	2	0	0	.	.	.
DIALLATE	1	0	0	2	0	0	.	.	.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP)
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 1		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
EPTAM	1	0	0	2	0	0	.	.	.
IPC	1	0	0	2	0	0	.	.	.
PROPOXUR	1	0	0	2	0	0	.	.	.
CARBARYL	1	0	0	2	0	0	.	.	.
BUTYLATE	1	0	0	2	0	0	.	.	.
*TOTAL SCAN SPECIFIC PESTICIDES	31	0	0	57	0	0	4	0	0
VOLATILES									
BENZENE	6	0	1	6	0	1	6	0	1
TOLUENE	6	0	0	6	0	0	6	0	0
ETHYLBENZENE	6	0	3	6	0	3	6	0	4
P-XYLENE	6	0	0	6	0	0	6	0	0
M-XYLENE	6	0	0	6	0	0	6	0	1
O-XYLENE	6	0	0	6	0	0	6	0	1
STYRENE	6	0	5	6	0	0	6	0	1
1,1 DICHLOROETHYLENE	6	0	0	6	0	0	6	0	0
METHYLENE CHLORIDE	6	0	0	6	0	0	6	0	0
T1,2DICHLOROETHYLENE	6	0	0	6	0	0	6	0	0
1,1 DICHLOROETHANE	6	0	0	6	0	0	6	0	0
CHLOROFORM	6	0	1	6	6	0	6	6	0
111, TRICHLOROETHANE	6	0	0	6	0	0	6	0	0
1,2 DICHLOROETHANE	6	0	0	6	0	0	6	0	0
CARBON TETRACHLORIDE	6	0	0	6	0	0	6	0	0
1,2 DICHLOROPROPANE	6	0	0	6	0	0	6	0	0
TRICHLOROETHYLENE	6	0	0	6	0	0	6	0	0
DICHLOROBROMOMETHANE	6	0	0	6	6	0	6	6	0
112 TRICHLOROETHANE	6	0	0	6	0	0	6	0	0
CHLORODIBROMOMETHANE	6	0	0	6	6	0	6	6	0
T-CHLOROETHYLENE	6	0	0	6	0	0	6	0	0
BROMOFORM	6	0	0	6	0	6	6	0	5
1122 T-CHLOROETHANE	6	0	0	6	0	0	6	0	0
CHLOROBENZENE	6	0	0	6	0	0	6	0	0
1,4 DICHLOROBENZENE	6	0	0	6	0	0	6	0	0
1,3 DICHLOROBENZENE	6	0	0	6	0	0	6	0	0
1,2 DICHLOROBENZENE	6	0	0	6	0	0	6	0	0
ETHLYENE DIBROMIDE	6	0	0	6	0	0	6	0	0
TOTL TRIHALOMETHANES	6	0	0	6	6	0	6	6	0
*TOTAL SCAN VOLATILES	174	0	10	174	24	10	174	24	13
*TOTAL GROUP ORGANIC	573	0	18	603	24	17	318	24	17

KEY TO TABLE 5 and 6

A ONTARIO DRINKING WATER OBJECTIVES (ODWO)
1. Maximum Acceptable Concentration (MAC)
1+. MAC for Total Trihalomethanes
2. Interim Maximum Acceptable Concentration (IMAC)
3. Aesthetic Objective (AO)
3*. AO for Total Xylenes
4. Recommended Operational Guideline

B HEALTH & WELFARE CANADA (H&W)
1. Maximum Acceptable Concentration (MAC)
2. Proposed MAC
3. Interim MAC
4. Aesthetic Objective (AO)

C WORLD HEALTH ORGANIZATION (WHO)
1. Guideline Value (GV)
2. Tentative GV
3. Aesthetic GV

D US ENVIRONMENTAL PROTECTION AGENCY (EPA)
1. Maximum Contaminant Level (MCL)
2. Suggested No-Adverse Effect Level (SNAEL)
3. Lifetime Health Advisory
4. EPA Ambient Water Quality Criteria
4T. EPA Ambient Water Quality Criteria for Total PAH

F EUROPEAN ECONOMIC COMMUNITY (EEC)
1. Health Related Guideline Level
2. Aesthetic Guideline Level
3. Maximum Admissable Concentration (MADC)

G CALIFORNIA STATE DEPARTMENT OF HEALTH-GUIDELINE VALUE

I NEW YORK STATE AMBIENT WATER GUIDELINE

N/A NONE AVAILABLE

LABORATORY RESULTS, REMARK DESCRIPTIONS

.	No Sample Taken
BDL	Below Minimum Measurement Amount
<T	Greater Than Detection Limit But Not Confident (SEE INTERPRETATION OF RESULTS ABOVE)
>	Results Are Greater Than The Upper Limit
<=>	Approximate Result
!CS	No Data: Contamination Suspected
!IL	No Data: Sample Incorrectly Labelled
!IS	No Data: Insufficient Sample
!IV	No Data: Inverted Septum
!LA	No Data: Laboratory Accident
!LD	No Data: Test Queued After Sample Discarded
!NA	No Data: No Authorization To Perform Reanalysis
!NP	No Data: No Procedure
!NR	No Data: Sample Not Received
!OP	No Data: Obscured Plate
!QU	No Data: Quality Control Unacceptable
!PE	No Data: Procedural Error - Sample Discarded
!PH	No Data: Sample pH Outside Valid Range
!RE	No Data: Received Empty
!RO	No Data: See Attached Report (no numeric results)
!SM	No Data: Sample Missing
!SS	No Data: Send Separate Sample Properly Preserved
!UI	No Data: Indeterminant Interference
!TX	No Data: Time Expired
A3C	Approximate, Total Count Exceeded 300 Colonies
APL	Additional Peak, Large, Not Priority Pollutant
APS	Additional Peak, Less Than, Not Priority Pollutant
CIC	Possible Contamination, Improper Cap
CRO	Calculated Result Only
PPS	Test Performed On Preserved Sample
RMP	P and M-Xylene Not Separated
RRV	Rerun Verification
RVU	Reported Value Unusual
SPS	Several Peaks, Small, Not Priority Pollutant

UCR		Unreliable: Could Not Confirm By Reanalysis
UCS		Unreliable: Contamination Suspected
UIN		Unreliable: Indeterminate Interference
XP		Positive After X Number Of Hours
T#	(T06)	Result Taken After # Hours

TABLE 5

DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
BACTERIOLOGICAL				
FECAL COLIFORM MF (CT/100ML)			DET'N LIMIT = 0	GUIDELINE = 0 (A1)
JAN	0	.	.	.
STANDRD PLATE CNT MF (CT/ML)			DET'N LIMIT = 0	GUIDELINE = 500/ML (A3)
JAN	.	680	.	1 <=>
MAR	.	2400 >	.	0 <=>
MAY	.	0 <=>	.	32
JUL	.	2400 >	.	0 <=>
SEP	.	4 <=>	.	15
NOV	.	0 <=>	.	8 <=>
T COLIFORM BCKGRD MF (CT/100ML)			DET'N LIMIT = 0	GUIDELINE = N/A
JAN	2	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
CHEMISTRY (FLD)				
FLD CHLORINE (COMB) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
JAN	.	.140	.100	.100
MAR	.	.150	.100	.150
MAY	.	.150	.100	.100
JUL	.	.000	.100	.100
SEP	.	.150	.100	.100
NOV	.	.130	.100	.100
FLD CHLORINE FREE (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
JAN	.	.780	.100	.400
MAR	.	.800	.300	.500
MAY	.	.900	.100	.100
JUL	.	.000	.200	.600
SEP	.	.800	.050	.500
NOV	.	.800	.000	.600
FLD CHLORINE (TOTAL) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
JAN	.	.920	.200	.500
MAR	.	.950	.400	.650
MAY	.	1.050	.200	.200
JUL	.	.000	.300	.700
SEP	.	.950	.150	.600
NOV	.	.930	.100	.700
FLD PH (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = 6.5-8.5(A4)
JAN	7.990	7.250	7.400	7.400
MAR	8.220	7.310	7.500	7.500
MAY	7.800	7.200	7.100	7.200
JUL	8.090	7.200	7.350	7.350
SEP	8.140	7.280	7.500	7.500
NOV	8.000	7.220	7.300	7.300
FLD TEMPERATURE (DEG.C)			DET'N LIMIT = N/A	GUIDELINE = 15 (A3)
JAN	.110	2.700	17.010	6.110
MAR	2.000	3.000	18.500	6.200
MAY	7.500	9.000	20.000	12.000
JUL	16.300	17.800	24.000	18.500
SEP	21.000	22.000	22.000	20.050
NOV	11.000	11.000	19.000	15.000
FLD TURBIDITY (FTU)			DET'N LIMIT = N/A	GUIDELINE = 1 (A1)
JAN	.510	.060	.110	.090
MAR	1.200	.050	.150	.110
MAY	.750	.050	.100	.080
JUL	.540	.040	.080	.110
SEP	.520	.360	.110	.060
NOV	2.620	.030	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
CHEMISTRY (LAB)				
ALKALINITY (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 30-500 (A4)
JAN	83.900	77.900	78.600	78.400
MAR	85.800	79.100	78.400	78.400
MAY	83.500	75.700	75.800	75.800
JUL	84.700	74.400	75.100	75.200
SEP	84.300	75.400	75.800	75.700
NOV	81.100	76.100	77.300	77.400
CALCIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 100 (F2)
JAN	30.100	30.400	30.800	31.500
MAR	29.490	28.720	28.990	29.920
MAY	29.100	29.300	29.400	29.600
JUL	28.400	29.600	29.800	30.400
SEP	30.400	30.200	30.800	30.800
NOV	30.200	30.000	30.600	30.400
CHLORIDE (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 250 (A3)
JAN	6.100	7.000	7.200	6.900
MAR	6.100	7.300	7.200	7.200
MAY	5.900	7.200	7.200	7.100
JUL	6.300	7.800	7.800	7.800
SEP	6.000	7.200	7.300	7.500
NOV	5.300	6.800	6.400	6.700
COLOUR (HZU)			DET'N LIMIT = 0.5	GUIDELINE = 5 (A3)
JAN	1.000 <T	.500 <T	.500 <T	1.000 <T
MAR	.500 <T	BDL	.500 <T	.500 <T
MAY	.500 <T	.500 <T	BDL	BDL
JUL	.500 <T	.500 <T	.500 <T	.500 <T
SEP	1.000 <T	.500 <T	.500 <T	.500 <T
NOV	1.000 <T	BDL	BDL	BDL
CONDUCTIVITY (UMHO/CM)			DET'N LIMIT = 1.	GUIDELINE = 400 (F2)
JAN	216	218	222	219
MAR	220	225	224	224
MAY	218	223	223	223
JUL	219	225	226	226
SEP	217	223	224	223
NOV	210	223	224	225
DISS ORG CARBON (MG/L)			DET'N LIMIT = .100	GUIDELINE = 5.0 (A3)
JAN	1.500	1.400	1.600	1.400
MAR	1.400	1.200	1.200	1.200
MAY	1.500	1.300	1.200	1.300
JUL	1.800	1.400	1.300	1.300
SEP	1.600	1.300	1.300	1.300
NOV	1.600	1.200	1.200	1.200

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
FLUORIDE (MG/L)			DET'N LIMIT = 0.01	GUIDELINE = 2.4 (A1)
JAN	.100	1.220	1.200	1.160
MAR	.080	1.100	1.160	1.160
MAY	.080	1.340	1.320	1.320
JUL	.080	1.000	1.380	1.100
SEP	.080	.040 <T	.060	.060
NOV	.080	.060	.080	.100
HARDNESS (MG/L)			DET'N LIMIT = 0.5	GUIDELINE = 80-100 (A4)
JAN	106.300	107.100	108.500	109.500
MAR	105.600	105.100	104.900	108.000
MAY	103.600	103.500	104.300	105.400
JUL	103.000	107.000	108.000	109.000
SEP	107.000	107.000	108.000	108.000
NOV	106.000	106.000	107.000	106.000
IONCAL (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = N/A
JAN	3.129	5.190	5.925	7.094
MAR	.783	.958	2.085	5.346
MAY	.962	2.589	3.484	4.210
JUL	.298	4.290	5.287	5.351
SEP	4.529	3.898	4.754	4.216
NOV	7.124	2.987	2.726	1.639
LANGELIERS INDEX (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = N/A
JAN	.306	.177	.165	.105
MAR	.145	.037	-.003	.041
MAY	.179	-.203	-.211	-.188
JUL	.254	.103	.120	.149
SEP	.422	.138	.109	.069
NOV	.145	.070	.075	.092
MAGNESIUM (MG/L)			DET'N LIMIT = 0.1	GUIDELINE = 30 (F2)
JAN	7.550	7.600	7.650	7.500
MAR	7.750	8.100	7.900	8.200
MAY	7.500	7.350	7.550	7.650
JUL	7.900	7.900	8.200	8.100
SEP	7.700	7.700	7.700	7.600
NOV	7.450	7.500	7.500	7.400
SODIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 200 (A4)
JAN	3.400	3.500	3.700	3.500
MAR	3.500	3.400	3.500	3.400
MAY	3.400	3.500	3.400	3.400
JUL	4.000	4.000	4.000	4.000
SEP	3.600	3.600	3.600	3.600
NOV	3.350	3.600	3.400	3.400

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
AMMONIUM TOTAL (MG/L)			**DET'N LIMIT = 0.002**	**GUIDELINE = 0.05 (F2)**
JAN	BDL	BDL	BDL	BDL
MAR	BDL	BDL	BDL	BDL
MAY	BDL	BDL	BDL	BDL
JUL	BDL	.002 <T	BDL	BDL
SEP	.004 <T	BDL	.004 <T	BDL
NOV	BDL	BDL	.002 <T	.002 <T
NITRITE (MG/L)			**DET'N LIMIT = 0.001**	**GUIDELINE = 1 (A1)**
JAN	.001 <T	BDL	BDL	BDL
MAR	.005	.005	.007	.006
MAY	.004 <T	.001 <T	.003 <T	.001 <T
JUL	.004 <T	.001 <T	.001 <T	.001 <T
SEP	.003 <T	.002 <T	.002 <T	.001 <T
NOV	.005	BDL	.001 <T	BDL
TOTAL NITRATES (MG/L)			**DET'N LIMIT = 0.005**	**GUIDELINE = 10 (A1)**
JAN	.300	.305	.305	.305
MAR	.335	.350	.355	.350
MAY	.410	.415	.415	.415
JUL	.300	.300	.305	.295
SEP	.275	.280	.270	.270
NOV	.260	.265	.265	.265
NITROGEN TOT KJELD (MG/L)			**DET'N LIMIT = 0.02**	**GUIDELINE = N/A**
JAN	.200	.100	.120	.130
MAR	.160	.100	.100	.110
MAY	.160	.080 <T	.100	.080 <T
JUL	.180	.110	.110	.110
SEP	.110	.030 <T	.060 <T	.060 <T
NOV	.190	.170	.110	.110
PH (DMNSLESS)			**DET'N LIMIT = N/A**	**GUIDELINE = 6.5-8.5(A4)**
JAN	8.310	8.210	8.190	8.120
MAR	8.150	8.090	8.050	8.080
MAY	8.200	7.860	7.850	7.870
JUL	8.280	8.170	8.180	8.200
SEP	8.420	8.190	8.150	8.110
NOV	8.160	8.120	8.110	8.130
PHOSPHORUS FIL REACT (MG/L)			**DET'N LIMIT = 0.0005**	**GUIDELINE = N/A**
JAN	BDL	.003	.	.
MAR	.000 <T	.004	.	.
MAY	BDL	.003	.	.
JUL	BDL	.001 <T	.	.
SEP	BDL	BDL	.	.
NOV	.000 <T	.001 <T	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
PHOSPHORUS TOTAL (MG/L)			**DET'N LIMIT = 0.002**	**GUIDELINE = .40 (F2)**
JAN	.004 <T	.004 <T	.	.
MAR	.004 <T	.005 <T	.	.
MAY	.005 <T	.005 <T	.	.
JUL	.003 <T	.002 <T	.	.
SEP	.003 <T	BDL	.	.
NOV	.008 <T	.003 <T	.	.
SULPHATE (MG/L)			**DET'N LIMIT = .200**	**GUIDELINE = 500 (A3)**
JAN	15.860	19.400	19.220	19.300
MAR	15.950	19.860	19.540	19.320
MAY	15.860	20.030	19.830	20.080
JUL	16.380	22.910	22.790	23.650
SEP	15.920	23.040	23.080	23.070
NOV	15.610	22.680	23.340	23.120
TURBIDITY (FTU)			**DET'N LIMIT = 0.05**	**GUIDELINE = 1 (A1)**
JAN	.810	.880	.210 <T	.280
MAR	1.400	.380	.280	.470
MAY	1.200	.530	.240 <T	.300
JUL	.710	.480	.390	.330
SEP	.450	.280	.200	.190
NOV	2.700	.270	.300	.270

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
METALS				
ALUMINUM (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 100 (A4)
JAN	7.800	53.000	45.000	45.000
MAR	10.000	45.000	66.000	43.000
MAY	15.000	75.000	63.000	60.000
JUL	7.300	86.000	92.000	90.000
SEP	5.500	140.000	87.000	120.000
NOV	28.000	51.000	52.000	56.000
ARSENIC (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 25 (A1)
JAN	.590 <T	.790 <T	.450 <T	.740 <T
MAR	.600 <T	.720 <T	.800 <T	.550 <T
MAY	.470 <T	.730 <T	.670 <T	.740 <T
JUL	.380 <T	.430 <T	.550 <T	.630 <T
SEP	.530 <T	.350 <T	.480 <T	.270 <T
NOV	.650 <T	.260 <T	.420 <T	.430 <T
BARIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 1000 (A2)
JAN	16.000	15.000	17.000	15.000
MAR	14.000	14.000	15.000	15.000
MAY	14.000	14.000	15.000	14.000
JUL	14.000	14.000	15.000	14.000
SEP	14.000	14.000	14.000	14.000
NOV	13.000	13.000	13.000	13.000
BORON (UG/L)			DET'N LIMIT = 2.00	GUIDELINE = 5000 (A1)
JAN	15.000 <T	15.000 <T	18.000 <T	15.000 <T
MAR	18.000 <T	18.000 <T	16.000 <T	19.000 <T
MAY	46.000	13.000 <T	51.000	47.000
JUL	17.000 <T	16.000 <T	17.000 <T	16.000 <T
SEP	27.000	20.000 <T	26.000	25.000
NOV	12.000 <T	11.000 <T	14.000 <T	15.000 <T
CADMIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 5 (A1)
JAN	BDL	BDL	.080 <T	BDL
MAR	BDL	BDL	BDL	BDL
MAY	BDL	BDL	BDL	BDL
JUL	BDL	BDL	BDL	BDL
SEP	BDL	.230 <T	BDL	BDL
NOV	BDL	BDL	BDL	BDL
COBALT (UG/L)			DET'N LIMIT = 0.02	GUIDELINE = N/A
JAN	.100 <T	.150 <T	.110 <T	.080 <T
MAR	.110 <T	.070 <T	BDL	.060 <T
MAY	.090 <T	.110 <T	.090 <T	.110 <T
JUL	BDL	.090 <T	.040 <T	.050 <T
SEP	BDL	.070 <T	BDL	BDL
NOV	BDL	.070 <T	BDL	BDL

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
CHROMIUM (UG/L)			**DET'N LIMIT = 0.50**	**GUIDELINE = 50 (A1)**
JAN	BDL	BDL	BDL	BDL
MAR	.980 <T	1.600 <T	1.300 <T	1.600 <T
MAY	2.000 <T	BDL	2.300 <T	1.900 <T
JUL	1.700 <T	2.000 <T	2.200 <T	2.000 <T
SEP	2.100 <T	1.600 <T	2.400 <T	2.600 <T
NOV	.730 <T	.850 <T	1.600 <T	1.900 <T
COPPER (UG/L)			**DET'N LIMIT = 0.50**	**GUIDELINE = 1000 (A3)**
JAN	22.000	11.000	220.000	4.400 <T
MAR	21.000	12.000	260.000	34.000
MAY	28.000	3.100 <T	36.000	5.000 <T
JUL	38.000	5.900	19.000	3.400 <T
SEP	45.000	1.800 <T	85.000	2.300 <T
NOV	29.000	1.300 <T	47.000	2.400 <T
IRON (UG/L)			**DET'N LIMIT = 6.00**	**GUIDELINE = 300 (A3)**
JAN	8.500 <T	31.000 <T	21.000 <T	18.000 <T
MAR	9.500 <T	10.000 <T	10.000 <T	10.000 <T
MAY	11.000 <T	38.000 <T	BDL	BDL
JUL	BDL	25.000 <T	12.000 <T	12.000 <T
SEP	BDL	14.000 <T	11.000 <T	16.000 <T
NOV	53.000 <T	BDL	BDL	BDL
MERCURY (UG/L)			**DET'N LIMIT = 0.02**	**GUIDELINE = 1 (A1)**
JAN	.040 <T	.040 <T	.	.
MAR	BDL	BDL	.	.
MAY	BDL	BDL	.	.
JUL	.040 <T	BDL	.	.
SEP	BDL	BDL	.	.
NOV	BDL	BDL	.	.
MANGANESE (UG/L)			**DET'N LIMIT = 0.05**	**GUIDELINE = 50 (A3)**
JAN	1.000	1.500	4.200	2.400
MAR	1.200	.840	.980	3.400
MAY	1.100	2.400	.220 <T	1.000
JUL	1.000	1.600	.680	1.100
SEP	.420 <T	.410 <T	1.700	1.200
NOV	2.900	.110 <T	.370 <T	.710
MOLYBDENUM (UG/L)			**DET'N LIMIT = 0.05**	**GUIDELINE = N/A**
JAN	.470 <T	.540	.580	.590
MAR	.480 <T	.380 <T	.470 <T	.560
MAY	.380 <T	.360 <T	.460 <T	.410 <T
JUL	.470 <T	.500 <T	.640	.530
SEP	.540	.430 <T	.460 <T	.480 <T
NOV	.430 <T	.390 <T	.440 <T	.480 <T

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
NICKEL (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 350 (D3)
JAN	.680 <T	.570 <T	1.300 <T	.700 <T
MAR	BDL	BDL	7.700	BDL
MAY	.870 <T	.820 <T	3.000	.460 <T
JUL	.250 <T	BDL	.240 <T	.460 <T
SEP	.210 <T	BDL	.570 <T	BDL
NOV	.240 <T	BDL	.430 <T	BDL
LEAD (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 10. (A1)
JAN	.190 <T	.170 <T	22.000	.510
MAR	.130 <T	.180 <T	18.800	2.800
MAY	.090 <T	.280 <T	2.400	.350 <T
JUL	.130 <T	.370 <T	3.300	.590
SEP	.170 <T	.170 <T	16.000	.680
NOV	.220 <T	BDL	7.700	.350 <T
ANTIMONY (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 146 (D4)
JAN	.580	.540	.770	.420 <T
MAR	.500 <T	.500 <T	.430 <T	.860
MAY	.330 <T	.350 <T	.440 <T	.530
JUL	.490 <T	.570	.540	.280 <T
SEP	.560	.290 <T	.490 <T	.360 <T
NOV	.320 <T	.350 <T	.400 <T	.350 <T
SELENIUM (UG/L)			DET'N LIMIT = 1.00	GUIDELINE = 10 (A1)
JAN	1.100 <T	BDL	BDL	1.100 <T
MAR	BDL	BDL	1.400 <T	BDL
MAY	BDL	BDL	1.600 <T	BDL
JUL	BDL	BDL	1.800 <T	1.100 <T
SEP	BDL	BDL	BDL	BDL
NOV	BDL	BDL	BDL	1.200 <T
STRONTIUM (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = N/A
JAN	110.000	110.000	110.000	100.000
MAR	100.000	100.000	99.000	110.000
MAY	99.000	94.000	99.000	100.000
JUL	100.000	99.000	100.000	99.000
SEP	110.000	110.000	110.000	110.000
NOV	93.000	95.000	96.000	97.000
TITANIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A
JAN	2.500 <T	2.600 <T	2.500 <T	2.600 <T
MAR	4.900 <T	4.500 <T	7.300	5.400
MAY	4.900 <T	4.700 <T	5.100	6.400
JUL	4.600 <T	4.500 <T	5.300	6.000
SEP	3.200 <T	3.200 <T	3.600 <T	3.100 <T
NOV	2.500 <T	1.800 <T	2.000 <T	2.100 <T

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
URANIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 100 (A1)
JAN	.190 <T	.180 <T	.160 <T	.180 <T
MAR	.190 <T	.180 <T	.150 <T	.120 <T
MAY	.170 <T	.130 <T	.110 <T	.200 <T
JUL	.200 <T	.120 <T	.110 <T	.090 <T
SEP	.140 <T	.090 <T	.070 <T	.090 <T
NOV	.170 <T	.070 <T	.070 <T	.090 <T
VANADIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A
JAN	.220 <T	.430 <T	.380 <T	.390 <T
MAR	.190 <T	.520	.610	.450 <T
MAY	.170 <T	.400 <T	.520	.430 <T
JUL	.190 <T	.530	.620	.590
SEP	.180 <T	.570	.450 <T	.560
NOV	.220 <T	.560	.420 <T	.480 <T
ZINC (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 5000 (A3)
JAN	1.900 <T	28.000	150.000	1.400 <T
MAR	1.800 <T	39.000	30.000	8.100
MAY	2.400	45.000	9.300	1.500 <T
JUL	2.000 <T	92.000	14.000	2.400
SEP	1.600 <T	20.000	86.000	1.900 <T
NOV	2.700	2.300	55.000	2.600

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
PESTICIDES & PCB				
ALPHA BHC (NG/L)			DET'N LIMIT = 1.000	GUIDELINE = 700 (G)
JAN	1.000 <T	1.000 <T	.	1.000 <T
MAR	2.000 <T	2.000 <T	.	2.000 <T
MAY	BDL	IIS	.	1.000 <T
JUL	1.000 <T	2.000 <T	.	IIS
SEP	2.000 <T	2.000 <T	.	2.000 <T
NOV	2.000 <T	2.000 <T	.	IIS

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM		
	RAW	TREATED	SITE 1		
			STANDING	FREE FLOW	
PHENOLICS (UG/L PHENOLICS)			DET'N LIMIT = .200	GUIDELINE = 2	(A4)
JAN	.400 <T	.800 <T	.	.	
MAR	.600 <T	BDL	.	.	
MAY	BDL	BDL	.	.	
JUL	BDL	BDL	.	.	
SEP	BDL	.400 <T	.	.	
NOV	.050 <T	BDL	.	.	

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
VOLATILES				
BENZENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 5 (A1)
JAN	BDL	BDL		BDL
MAR	.100 <T	.100 <T		.150 <T
MAY	BDL	BDL		BDL
JUL	BDL	BDL		BDL
SEP	BDL	BDL		BDL
NOV	BDL	BDL		BDL
ETHYLBENZENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 2.4 (A3)
JAN	BDL	BDL		BDL
MAR	.200 <T	.150 <T		.150 <T
MAY	.200 <T	.100 <T		.050 <T
JUL	BDL	BDL		.050 <T
SEP	BDL	BDL		BDL
NOV	.200 <T	.100 <T		.100 <T
M-XYLENE (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 300 (A3*)
JAN	BDL	BDL		BDL
MAR	BDL	BDL		.100 <T
MAY	BDL	BDL		BDL
JUL	BDL	BDL		BDL
SEP	BDL	BDL		BDL
NOV	BDL	BDL		BDL
O-XYLENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 300 (A3*)
JAN	BDL	BDL		BDL
MAR	BDL	BDL		.100 <T
MAY	BDL	BDL		BDL
JUL	BDL	BDL		BDL
SEP	BDL	BDL		BDL
NOV	BDL	BDL		BDL
STYRENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 100 (D1)
JAN	.200 <T	BDL		BDL
MAR	.350 <T	BDL		BDL
MAY	.400 <T	BDL		BDL
JUL	.050 <T	BDL		BDL
SEP	BDL	BDL		BDL
NOV	.350 <T	BDL		.100 <T
CHLOROFORM (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 350 (A1+)
JAN	BDL	22.300		17.900
MAR	.200 <T	14.900		13.700
MAY	BDL	17.300		16.200
JUL	BDL	21.900		19.800
SEP	BDL	23.300		25.600
NOV	BDL	14.300		16.000

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM SARNIA (LAMBTON COUNTY WTP) 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 1	
			STANDING	FREE FLOW
DICHLOROBROMOMETHANE (UG/L)		DET'N LIMIT = 0.05		GUIDELINE = 350 (A1+)
JAN	BDL	9.700	.	9.100
MAR	BDL	8.200	.	7.800
MAY	BDL	8.200	.	7.800
JUL	BDL	9.600	.	9.200
SEP	BDL	9.850	.	10.350
NOV	BDL	7.500	.	7.500
CHLORODIBROMOMETHANE (UG/L)		DET'N LIMIT = 0.10		GUIDELINE = 350 (A1+)
JAN	BDL	3.700	.	2.700
MAR	BDL	3.000	.	2.900
MAY	BDL	3.000	.	3.000
JUL	BDL	3.400	.	3.400
SEP	BDL	3.500	.	3.600
NOV	BDL	2.700	.	2.700
BROMOFORM (UG/L)		DET'N LIMIT = 0.20		GUIDELINE = 350 (A1+)
JAN	BDL	.200 <T	.	BDL
MAR	BDL	.200 <T	.	.200 <T
MAY	BDL	.200 <T	.	.200 <T
JUL	BDL	.200 <T	.	.400 <T
SEP	BDL	.200 <T	.	.200 <T
NOV	BDL	.200 <T	.	.200 <T
TOTL TRIHALOMETHANES (UG/L)		DET'N LIMIT = 0.50		GUIDELINE = 350 (A1)
JAN	BDL	35.950	.	29.700
MAR	BDL	26.300	.	24.550
MAY	BDL	28.700	.	27.200
JUL	BDL	35.200	.	32.800
SEP	BDL	36.800	.	39.800
NOV	BDL	24.750	.	26.400

TRACE LEVELS OF TOLUENE ARE LABORATORY ARTIFACTS DERIVED FROM THE ANALYTICAL METHODOLOGY.

TRACE LEVELS OF STYRENE ARE CONSIDERED TO BE LABORATORY ARTIFACTS RESULTING FROM THE LABORATORY SHIPPING CONTAINERS.

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
BACTERIOLOGICAL			
FECAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	0 (A1)
STANDARD PLATE COUNT MEMBRANE FILT.	CT/ML	0	500/ML (A3)
TOTAL COLIFORM BACKGROUND MF	CT/100ML	0	N/A
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	5/100ML (A1)
CHEMISTRY (FLD)			
FIELD COMBINED CHLORINE RESIDUAL	MG/L	0	N/A
FIELD TOTAL CHLORINE RESIDUAL	MG/L	0	N/A
FIELD FREE CHLORINE RESIDUAL	MG/L	0	N/A
FIELD PH	DMNSLESS	N/A	6.5-8.5 (A3)
FIELD TEMPERATURE	DEG.C	N/A	15.0 (A3)
FIELD TURBIDITY	FTU	N/A	1.0 (A1)
CHEMISTRY (LAB)			
ALKALINITY	MG/L	0.2	30-500 (A3)
AMMONIUM TOTAL	MG/L	0.002	0.05 (F2)
CALCIUM	MG/L	0.2	100 (F2)
CHLORIDE	MG/L	0.2	250 (A3)
COLOUR	TCU	0.5	5.0 (A3)
CONDUCTIVITY	UMHO/CM	1.0	400 (F2)
CYANIDE	MG/L	0.001	0.2 (A1)
DISSOLVED ORGANIC CARBON	MG/L	0.1	5.0 (A3)
FLUORIDE	MG/L	0.01	2.4 (A1)
HARDNESS	MG/L	0.5	80-100 (A4)
LANGELIERS INDEX	DMNSLESS	N/A	N/A
MAGNESIUM	MG/L	0.1	30.0 (F2)
NITRITE	MG/L	0.001	1.0 (A1)
NITROGEN TOTAL KJELDAHL	MG/L	0.02	N/A
PH	DMNSLESS	N/A	6.5-8.5 (A4)
PHOSPHORUS FIL REACT	MG/L	0.0005	N/A
PHOSPHORUS TOTAL	MG/L	0.002	0.4 (F2)
SODIUM	MG/L	0.2	200 (A4)
SULPHATE	MG/L	0.2	500 (A3)
TOTAL NITRATES	MG/L	0.005	10.0 (A1)
TURBIDITY	FTU	0.05	1.0 (A1)
CHLOROAROMATICS			
123 TRICHLOROBENZENE	NG/L	5.0	N/A
1234 TETRACHLOROBENZENE	NG/L	1.0	N/A
1235 TETRACHLOROBENZENE	NG/L	1.0	N/A
124 TRICHLOROBENZENE	NG/L	5.0	10000 (I)
1245-TETRACHLOROBENZENE	NG/L	1.0	38000 (D4)
135 TRICHLOROBENZENE	NG/L	5.0	N/A
236 TRICHLOROTOLUENE	NG/L	5.0	N/A
245 TRICHLOROTOLUENE	NG/L	5.0	N/A
26A TRICHLOROTOLUENE	NG/L	5.0	N/A
HEXACHLOROBENZENE	NG/L	1.0	10 (C1)
HEXACHLOROBUTADIENE	NG/L	1.0	450 (D4)
HEXACHLOROCYCLOPENTADIENE	NG/L	5.0	206000 (D4)
HEXACHLOROETHANE	NG/L	1.0	1900 (D4)
OCTACHLOROSTYRENE	NG/L	1.0	N/A
PENTACHLOROBENZENE	NG/L	1.0	74000 (D4)
CHLOROPHENOLS			
234 TRICHLOROPHENOL	NG/L	100.0	N/A
2345 TETRACHLOROPHENOL	NG/L	20.0	N/A
2356 TETRACHLOROPHENOL	NG/L	10.0	N/A

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
245 TRICHLOROPHENOL	NG/L	100.0	2600000 (D4)
246 TRICHLOROPHENOL	NG/L	20.0	5000 (A1)
PENTACHLOROPHENOL	NG/L	10.0	60000 (A1)
METALS			
ALUMINUM	UG/L	0.10	100 (A4)
ANTIMONY	UG/L	0.05	146 (D4)
ARSENIC	UG/L	0.10	25 (A1)
BARIUM	UG/L	0.05	1000 (A2)
BERYLLIUM	UG/L	0.05	6800 (D4)
BORON	UG/L	2.00	5000 (A1)
CADMIUM	UG/L	0.05	5 (A1)
CHROMIUM	UG/L	0.50	50 (A1)
COBALT	UG/L	0.02	N/A
COPPER	UG/L	0.50	1000 (A3)
IRON	UG/L	6.00	300 (A3)
LEAD	UG/L	0.05	10 (A1)
MANGANESE	UG/L	0.05	50 (A3)
MERCURY	UG/L	0.02	1 (A1)
MOLYBDENUM	UG/L	0.05	N/A
NICKEL	UG/L	0.20	350 (D3)
SELENIUM	UG/L	1.00	10 (A1)
SILVER	UG/L	0.05	50 (A1)
STRONTIUM	UG/L	0.10	N/A
THALLIUM	UG/L	0.05	13 (D4)
TITANIUM	UG/L	0.50	N/A
URANIUM	UG/L	0.05	100 (A1)
VANADIUM	UG/L	0.05	N/A
ZINC	UG/L	0.20	5000 (A3)
PAH			
ANTHRACENE	NG/L	1.0	N/A
BENZO(A) ANTHRACENE	NG/L	20.0	N/A
BENZO(A) PYRENE	NG/L	5.0	10.0 (A1)
BENZO(B) CHRYSENE	NG/L	2.0	N/A
BENZO(B) FLUORANTHENE	NG/L	10.0	N/A
BENZO(E) PYRENE	NG/L	50.0	N/A
BENZO(G,H,I) PERYLENE	NG/L	20.0	N/A
BENZO(K) FLUORANTHENE	NG/L	1.0	N/A
CHRYSENE	NG/L	50.0	N/A
CORONENE	NG/L	10.0	N/A
DIBENZO(A,H) ANTHRACENE	NG/L	10.0	N/A
DIMETHYL BENZO(A) ANTHRACENE	NG/L	5.0	N/A
FLUORANTHENE	NG/L	20.0	42000.0 (D4)
INDENO(1,2,3-C,D) PYRENE	NG/L	20.0	N/A
PERYLENE	NG/L	10.0	N/A
PHENANTHRENE	NG/L	10.0	N/A
PYRENE	NG/L	20.0	N/A
PESTICIDES & PCB			
ALACHLOR (LASSO)	NG/L	500.0	5000 (A2)
ALDRIN	NG/L	1.0	700 (A1)
ALPHA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	700 (G)
ALPHA CHLORDANE	NG/L	2.0	7000 (A1)
AMETRINE	NG/L	50.0	300000 (D3)
ATRATONE	NG/L	50.0	N/A
ATRAZINE	NG/L	50.0	60000 (A2)
DES ETHYL ATRAZINE	NG/L	200.0	60000 (A2)
BETA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	300 (G)
CYANAZINE (BLADEX)	NG/L	100.0	10000 (A2)
O,P-DDD	NG/L	5.0	10 (I)
DIELDRIN	NG/L	2.0	700 (A1)
ENDOSULFAN 1 (THIODAN I)	NG/L	2.0	74000 (D4)
ENDOSULFAN 2 (THIODAN II)	NG/L	5.0	74000 (D4)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
ENDOSULFAN SULPHATE (THIODAN SULPHATE)	NG/L	5.0	N/A
ENDRIN	NG/L	5.0	1600 (D3)
GAMMA CHLORDANE	NG/L	2.0	7000 (A1)
HEPTACHLOR	NG/L	1.0	3000 (A1)
HEPTACHLOR EPOXIDE	NG/L	1.0	3000 (A1)
LINDANE (GAMMA BHC)	NG/L	1.0	4000 (A1)
METHOXYCHLOR	NG/L	5.0	900000 (A1)
METOLACHLOR	NG/L	500.0	50000 (A2)
METRIBUZIN (SENCOR)	NG/L	100.0	80000 (A1)
MIREX	NG/L	5.0	N/A
P,P-DDD	NG/L	5.0	N/A
O,P-DDT	NG/L	5.0	30000 (A1)
OXYCHLORDANE	NG/L	2.0	N/A
PCB	NG/L	20.0	3000 (A2)
PPDDE	NG/L	1.0	30000 (A1)
PPDDT	NG/L	5.0	30000 (A1)
PROMETONE	NG/L	50.0	52500 (D3)
PROMETRYNE	NG/L	50.0	1000 (A2)
PROPAZINE	NG/L	50.0	700000 (D3)
SIMAZINE	NG/L	50.0	10000 (A2)
D-ETHYL SIMAZINE	NG/L	200.0	10000 (A2)
TOXAPHENE	NG/L	500.0	5000 (A1)
PHENOLICS			
PHENOLICS (UNFILTERED REACTIVE)	UG/L	0.2	2 (A4)
SPECIFIC PESTICIDES			
2,4 D PROPIONIC ACID	NG/L	100.	N/A
2,4,5-TRICHLOROPHENOXY ACETIC ACID	NG/L	50.	280000 (A1)
2,4-DICHLOROBUTYRIC ACID (2,4-D)	NG/L	100.	100000 (A1)
24-DICHLORORPHENOXYBUTYRIC ACID (24-DB)	NG/L	200.	18000 (B3)
BUTYLATE (SUTAN)	NG/L	2000.	245000 (D3)
CARBARYL (SEVIN)	NG/L	200.	90000 (A1)
CARBOFURAN	NG/L	2000.	90000 (A1)
CHLORPYRIFOS (DURSBAN)	NG/L	20.	N/A
CICP (CHLORPROPHAM)	NG/L	2000.	350000 (G)
DIALLATE	NG/L	2000.	N/A
DIAZINON	NG/L	20.	20000 (A1)
DICAMBA	NG/L	50.	120000 (A1)
DICHLOROVOS	NG/L	20.	N/A
EPTAM	NG/L	2000.	N/A
ETHION	NG/L	20.	35000 (G)
IPC	NG/L	2000.	N/A
MALATHION	NG/L	20.	190000 (A1)
METHYL PARATHION	NG/L	50.	7000 (B3)
METHYLTRITHION	NG/L	20.	N/A
MEVINPHOS	NG/L	20.	N/A
PARATHION	NG/L	20.	50000 (A1)
PHORATE (THIMET)	NG/L	20.	2000 (A2)
PROPOXUR (BAYGON)	NG/L	2000.	140000 (D3)
RELDAN	NG/L	20.	N/A
RONNEL	NG/L	20.	N/A
SILVEX (2,4,5-TP)	NG/L	20.	10000 (A1)
VOLATILES			
1,1 DICHLOROETHANE	UG/L	0.10	N/A
1,1 DICHLOROETHYLENE	UG/L	0.10	7 (D1)
1,2 DICHLOROBENZENE	UG/L	0.05	200 (A1)
1,2 DICHLOROETHANE	UG/L	0.05	5 (A1)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
1,2 DICHLOROPROPANE	UG/L	0.05	5 (D1)
1,3 DICHLOROBENZENE	UG/L	0.10	3750 (D3)
1,4 DICHLOROBENZENE	UG/L	0.10	5 (A1)
111, TRICHLOROETHANE	UG/L	0.02	200 (D1)
112 TRICHLOROETHANE	UG/L	0.05	0.6 (D4)
1122 TETRACHLOROETHANE	UG/L	0.05	0.17(D4)
BENZENE	UG/L	0.05	5 (A1)
BROMOFORM	UG/L	0.20	350 (A1+)
CARBON TETRACHLORIDE	UG/L	0.20	5 (A1)
CHLOROBENZENE	UG/L	0.10	1510 (D3)
CHLORODIBROMOMETHANE	UG/L	0.10	350 (A1+)
CHLOROFORM	UG/L	0.10	350 (A1+)
DICHLOROBROMOMETHANE	UG/L	0.05	350 (A1+)
ETHLYENE DIBROMIDE	UG/L	0.05	50 (D1)
ETHYLBENZENE	UG/L	0.05	2.4 (A3)
M-XYLENE	UG/L	0.10	300 (A3*)
METHYLENE CHLORIDE	UG/L	0.50	50 (A1)
O-XYLENE	UG/L	0.05	300 (A3*)
P-XYLENE	UG/L	0.10	300 (A3*)
STYRENE	UG/L	0.05	100 (D1)
TETRACHLOROETHYLENE	UG/L	0.05	5 (D1)
TRANS 1,2 DICHLOROETHYLENE	UG/L	0.10	70 (D1)
TOLUENE	UG/L	0.05	24 (A3)
TOTAL TRIHALOMETHANES	UG/L	0.50	350 (A1)
TRICHLOROETHYLENE	UG/L	0.10	50 (A1)

Appendix A

DRINKING WATER SURVEILLANCE PROGRAM
PROGRAM DESCRIPTION

The Drinking Water Surveillance Program (DWSP) for Ontario monitors drinking water quality at municipal water supply systems. The DWSP Database Management System provides a computerized drinking water quality information system for the supplies monitored. The objectives of the program are to provide:

- immediate, reliable, current information on drinking water quality;
- a flagging mechanism for guideline exceedance;
- a definition of contaminant levels and trends;
- a comprehensive background for remedial action;
- a framework for assessment of new contaminants; and
- an indication of treatment efficiency of plant processes.

PROGRAM

The DWSP officially began in April 1986 and is designed to eventually include all municipal water supplies in Ontario. In 1990, 76 systems were being monitored. Water supply locations have been prioritized for surveillance based primarily on criteria such as population density, probability of contamination and geographical location.

An ongoing assessment of future monitoring requirements at each location will be made. Monitoring will continue at the initial locations at an appropriate level and further locations will be phased into the program as resources permit.

A major goal of the program is to collect valid water quality data in context with plant operational characteristics at the time of sampling. As soon as sufficient data have been accumulated and analyzed, both the frequency of sampling and the range of parameters may be adjusted accordingly.

Assessments are carried out at all locations prior to initial sampling, in order to acquire complete plant process and distribution system details and to designate (and retrofit if necessary) all sampling systems and locations. This ensures that the sampled water is a reflection of the water itself.

Samples are taken of raw (ambient water) and treated water at the treatment plant and of consumer's tap water in the distribution system. In order to determine possible effects of distribution on water quality, both standing and free flow water in old and new sections of the distribution system are sampled. Sampling is carried out by operational personnel who have been trained in applicable procedures.

Comprehensive standardized procedures and field test kits are supplied to sampling personnel. This ensures that samples are taken and handled according to standard protocols and that field testing will supply reliable data. All field and laboratory analyses are carried out using "approved documented procedures". Most laboratory analyses are carried out by the Ministry of Environment (MOE), Laboratory Services Branch. Radionuclides are analyzed by the Ministry of Labour.

DATA REPORTING MECHANISM

When the analytical results are transferred from the MOE laboratory into the DWSP system, printouts of the completed analyses are sent to the MOE District Officer, the appropriate operational staff and are also retained by the DWSP unit.

PROGRAM INPUTS AND OUTPUTS

There are four major inputs and four major outputs in the program.

Program Input - Plant and Distribution System Description

The system description includes plant specific non-analytical information acquired through a questionnaire and an initial plant visit. During the initial assessment of the plant and distribution system, questionnaire content is verified and missing information added. It is intended that all data be kept current with scheduled annual updates.

The Plant and Distribution System Description consists of the following seven components:

1. PROCESS COMPONENT INVENTORY
All physical and chemical processes to which the water is subjected, from the intake pipe to the consumers' tap (where possible), are documented. These include: process type, general description of physical structures, material types, sizes, and retention time for each process within the plant. The processes may be as simple as transmission or as complex as carbon adsorption.

2. TREATMENT CHEMICALS
Chemicals used in the treatment processes, their function, application point, supplier and brand-name are recorded. Chemical dosages applied on the day of sampling are recorded in DWSP.

3. PROCESS CONTROL MEASUREMENTS
Documentation of in-plant monitoring of process parameters (eg. turbidity, chlorine residuals, pH, aluminum residuals) including methods used, monitoring locations and frequency is contained in this section. Except for the recorded Field Data, in-plant monitoring results are not retained in DWSP but are retained by the water treatment plant personnel.

4. DESIGN FLOW AND RETENTION TIME
Hydraulic capacity, designed and actual, is noted here. Retention time (the time that a block of water is retained in the plant) is also noted. Maximum, minimum and average flow, as well as a record of the flow rate on the day of sampling, are recorded in DWSP.

5. DISTRIBUTION SYSTEM DESCRIPTION
This area includes the storage and transmission characteristics of the distribution system after the water leaves the plant.

6. SAMPLING SYSTEM
Each plant is assessed for its adequacy in terms of the sampling of bacteriological, organic and inorganic parameters. Prime considerations in the assessment and design of the sampling system are:

i/ the sample is an accurate representation of the actual water condition, eg. raw water has had no chemical treatment;

ii/ the water being sampled is not being modified by the sampling system;

iii/ the sample tap must be in a clean area of the plant, preferably a lab area; and

iv/ the sample lines must be organically inert (no plastic, ideally stainless steel).

It is imperative that the sampled water be a reflection not of the sampling system but of the water itself.

The sampling system documentation includes: origin of the water; date sampling was initiated; size, length and material type (intake, discharge and tap); pump characteristics (model, type, capacity); and flow rate.

7. PERSONNEL
This section contains the names, addresses and phone numbers of current plant management and operational staff, distribution system management and operational staff, Medical Officer of Health and appropriate MOE personnel associated with the plant.

<u>Program Input - Field Data</u>

The second major input to DWSP is field data. Field data is collected at the plant and from the distribution system sites on the day of sampling. Field data consists of general operating conditions and the results of testing for field parameters. General operating conditions include chemicals used, dosages, flow and retention time on the day of sampling, as well as, monthly maximum, minimum and average flows. Field parameters include turbidity, chlorine residuals (free, combined and total), temperature and pH. These parameters are analyzed according to standardized DWSP protocols to allow for interplant comparison.

Program Input - Laboratory Analytical Data

The third major input to DWSP is Laboratory Analytical Data. Samples gathered from the raw, treated and distribution sampling sites are analyzed for the presence of approximately 180 parameters at a frequency of two to twelve times per year. Sixty-five percent of the parameters are organic. Parameters measured may have health or aesthetic implications when present in drinking water. Many of the parameters may be used in the treatment process or may be treatment by-products. Due to the nature of certain analytical instruments, parameters may be measured in a "scan" producing some results for parameters that are not on the DWSP priority list, but which may be of interest. The majority of parameters are measured on a routine basis. Those that are technically more difficult and/or costly to analyze, however, are done less frequently. These include Specific Pesticides and Chlorophenols.

Although the parameter list is extensive, additional parameters with the potential to cause health or aesthetic related problems may be added provided reliable analytical and sampling methods exist.

All laboratory generated data is derived from standardized, documented analytical protocols. The analytical method is an integral part of the data and as methods change, notation will be made and comparison data documented.

Program Input - Parameter Reference Information

The fourth major input to DWSP is Parameter Reference Information. This is a catalogue of information for each substance analyzed on DWSP. It includes parameter name and aliases, physical and chemical properties, basic toxicology, world-wide health limits, treatment methods and uses. The Parameter Reference Information is computerized and can be accessed through the Query function of the DWSP database. An example is shown in figure 1.

Program output - Query

All DWSP information is easily accessed through the Query function, therefore, anything from addresses of plant personnel to complete water quality information for a plant's water supply is instantly available. The DWSP computer system makes relatively complex inquiries manageable. A personal password allowing access into the DWSP query mode in all MOE offices is being developed by the DWSP group.

Program Output - Action Alerts

Drinking Water quality in Ontario is evaluated against provincial objectives as outlined in the Ontario Drinking Water Objectives publication. Should the reported level of a substance in treated water exceed the Ontario Drinking Water Objective, an "Action Alert" requiring resampling and confirmation is issued. This assures that operational staff, health authorities and the public are notified as soon as

possible of the confirmation of an exceedance and remedial action taken. This report supplies a history of the occurrence of past exceedances at the plant plus a historical summary on the parameter of concern.

In the absence of Ontario Drinking Water Objectives, guidelines/limits from other agencies are used. The Parameter Listing System, published by MOE (ISBN 0-7729-4461-X), catalogues and keeps current guidelines for 650 parameters from agencies throughout the world. If these guidelines are exceeded, the results are flagged and evaluated by DWSP personnel. An "Action Alert" will be issued if warranted.

Program Output - Report Generation

Custom reports can be generated from DWSP to meet MOE Regional needs and to respond to public requests.

Program Output - Annual Reports

It is the practice of DWSP to produce an annual report containing analytical data along with companion plant information.

FIG.1

MOE - DRINKING WATER ASSESSMENT PROGRAM (DWSP)

PARAMETER REFERENCE INFORMATION

BENZENE (B2001P) VOLATILES

CLASS: HEALTH METHOD: POCODO UNIT: µg/L

SOURCE	FROM	TO	METHOD	GUIDELINE	UNIT	NOTE
CAL C	85/01			0.700	µg/L	AL
CDWG C	87/01			5.000	µg/L	MAC
EPA C	87/07			5.000	µg/L	MCL
EPAA C	80/11			6.600	µg/L	AMBIENT **
FERC C	84/05			1.000	µg/L	MCL
WHO C	84/01			10.000	µg/L	GV

DESCRIPTION:**NAME:** BENZENE
CAS#: 71-43-2
MOLECULAR FORMULAE: C_6H_6
DETECTION LIMIT: (FOR METHOD POCODO) 0.05 µg/L
SYNONYMS: BENZOL; BENZOLE; COAL NAPHTHA; CARBON OIL (27). CYCLOHEXATRIENE (41).
CHARACTERISTICS: COLOURLESS TO LIGHT-YELLOW, MOBILE, NON-POLAR LIQUID, OF HIGHLY REFRACTIVE NATURE, AROMATIC ODOUR; VAPOURS BURN WITH SMOKING FLAME (30).
PROPERTIES: SOLUBILITY IN WATER: 1780-1800 mg/L AT 25C (41). THRESHOLD ODOUR: 0.5 - 10 PPM IN WATERTHRESHOLD TASTE: 0.5 mg/L IN WATER (39).
ENVIRONMENTAL FATE: MAY BIOACCUMULATE IN LIVING ORGANISMS AND APPEARS TO ACCUMULATE IN ANIMAL TISSUES THAT EXHIBIT A HIGH LIPID CONTENT OR REPRESENT MAJOR METABOLIC SITES, SUCH AS LIVER OR BRAIN; SMALL QUANTITIES EVAPORATE FROM SOILS OR ARE DEGRADED RATHER QUICKLY (80).
SOURCES: COMMERCIAL: PETROLEUM REFINING; SOLVENT RECOVERY; COAL TAR DISTILLATION (39); FOOD PROCESSING AND TANNING INDUSTRIES; COMBUSTION OF CAR EXHAUST.
ENVIRONMENTAL: POSSIBLE SOURCE IS RUNOFF.
USES: DETERGENTS; NYLON; INTERMEDIATE IN PRODUCTION OF OTHER COMPOUNDS, SUCH AS PESTICIDES; SOLVENT FOR EXTRACTION AND RECTIFICATION IN RUBBER INDUSTRY; DEGREASING AND CLEANSING AGENT; GASOLINE.

TOXICITY: RATING: 4 (VERY TOXIC).
ACUTE: IRRITATING TO MUCOUS MEMBRANES; SYMPTOMS INCLUDE RESTLESSNESS, CONVULSIONS, EXCITEMENT,

DEPRESSION; DEATH MAY FOLLOW RESPIRATORY FAILURE.
CHRONIC: MAY CAUSE ANAEMIA AND LEUKAEMIA (45);
MUTAGENIC.
MODE OF ACTION: CHROMOABERRATION IN LYMPHOCYTE CULTURES.

CARCINOGENICITY: A KNOWN HUMAN CARCINOGEN.

REMOVAL: THE FOLLOWING PROCESSES HAVE BEEN SUCCESSFUL IN REMOVING BENZENE FROM WASTEWATER: GAC ADSORPTION, PRECIPITATION WITH ALUM AND SUBSEQUENT REMOVAL VIA SEDIMENTATION, COAGULATION AND FLOCCULATION, SOLVENT EXTRACTION, OXIDATION

ADDITIONAL PROPERTIES:

MOLECULAR WEIGHT: 78.12
MELTING POINT: 5.5°C (27).
BOILING POINT: 80.1°C (27).
SPECIFIC GRAVITY: 0.8790 AT 20°C (27).
VAPOUR PRESSURE: 100 MM AT 26.1°C (27).
HENRY'S LAW CONSTANT: 0.00555 ATM-M3/MOLE (41).
LOG OCT./WATER PARTITION COEFFICIENT: 1.95 TO 2.13 (39).
CARBON ADSORPTION: K=1.0; 1/N=1.6; R=0.97; PH=5.3 (41)SEDIMENT/WATER PARTITION COEFFICIENT: NO DATA

NOTES: EPA PRIORITY POLLUTANT.

Appendix B

DWSP SAMPLING GUIDELINE

i) Raw and Treated at Plant

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-220 mL plastic bottle with white seal on cap -do <u>not</u> rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)
Volatiles (duplicates) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do <u>not</u> rinse bottle -fill bottle completely without bubbles
Organics (OWOC),(OWTRI),(OAPAHX)	-1 L amber glass bottle per scan -do <u>not</u> rinse bottle -fill to 2 cm from top -when 'special pesticides' are requested three extra bottles must be filled
Cyanide	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops sodium hydroxide (NaOH) (**Caution:** NaOH is corrosive)
Mercury	-250 mL glass bottle -rinse bottle and cap three times -fill to top of label -add 20 drops each nitric acid (HNO_3) and potassium dichromate ($K_2Cr_2O_7$) (**Caution:** HNO_3&$K_2Cr_2O_7$ are corrosive)

Phenols	-250 mL glass bottle -do <u>not</u> rinse bottle, preservative has been added -fill to top of label
Radionuclides (as scheduled)	-4 L plastic jug -do <u>not</u> rinse, carrier added -fill to 5 cm from top
Organic Characterization (GC/MS - once per year)	-1 L amber glass bottle; instructions as per organic -250 mL glass bottle -do <u>not</u> rinse bottle -fill completely without bubbles

<u>Steps:</u>

1. Let sampling water tap run for an adequate time to clear the sample line.
2. Record time of day on submission sheet.
3. Record temperature on submission sheet.
4. Fill up all bottles as per instructions.
5. Record chlorine residuals (free, combined and total for treated water only), turbidity and pH on submission sheet.

ii) Distribution Samples (standing water)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)

Steps:

1. Record time of day on submission sheet.
2. Place bucket under tap and open cold water.
3. Fill to predetermined volume.
4. After mixing the water, record the temperature on the submission sheet.
5. Fill general chemistry and metals bottles.
6. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.

iii) Distribution Samples (free flow)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-250 mL plastic bottle with white seal on cap -do not rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid HNO_3 (**Caution:** HNO_3 is corrosive)
Volatiles (duplicate) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do not rinse bottle, preservative has been added -fill bottle completely without bubbles
Organics (OWOC) (OAPAHX)	-1 L amber glass bottle per scan -do not rinse bottle -fill to 2 cm from top

Steps:

1. Record time of day on submission sheet.
2. Let cold water flow for five minutes.
3. Record temperature on submission sheet.
4. Fill all bottles as per instructions.
5. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.